

NOTES ON THE COMMON LAND CRAB *PARATELPHUSA*  
(*BARYTELPHUSA*) *GUERINI* (M.-EDS.) OF SALSETTE  
ISLAND.

BY

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(With two plates).

At the Second Entomological Meeting held at Pusa in 1917 Mr. Bainbrigge Fletcher, Director of the Entomological Research Institute, Pusa, referring to the destruction of paddy crops by land crabs, remarked: 'Crabs have come into notoriety lately, especially in Madras, as paddy pests. In Bihar we have only had one report of crabs attacking paddy, but about five or six years ago we had a report from Karachi of damage by crabs in fields of young paddy. Recently they have come into prominence in Madras and Burma and there seems to be no doubt that crabs do some damage to rice plants.'

The Island of Salsette is infested with land crabs; but no utilitarian motive prompted me to investigate their habits. What really roused my curiosity was the appalling number of dead crabs lying about the fields and byways, in season and out of season. I wished to determine the probable cause of their death. But, as is usually the case in such enquiries, one point led to another and the net result was a collection of interesting notes which had little to do with the death-causing factor among crabs.

In this paper I deal with one single species, *Paratelphusa guerini*, and unless otherwise mentioned all my remarks are confined to it.

COLOUR.

*Adult*: At the time of their appearance, at the onset of the rains, these crabs display a wide range of colour. Some are a dirty white, others are purplish brown, and many are mottled with a mixture of both tints. Why this difference of colour? At first, I was under the impression it might be a sexual character, but an examination of several dozen soon dispelled this idea. The colour variation was common to both sexes. A second explanation suggested itself; that this colouring might possibly afford some particular advantage to the species, but a solution to this problem would have to be sought in its mode of life or its environment. The variation may or may not have some adaptive significance. Only observations in the field would suggest a solution to this interesting problem.

The crabs appear with the rains. Before the burst of the monsoon the ground is littered with dead leaves of almost every hue. Upon this variegated surface the crabs live. When disturbed

they either run a short distance and stop, or remain perfectly still, alert and on the defensive, with the pincers outspread ready to nip. When on the move, the crabs where possible avoid open ground and scurry under the leaves. Anyone who has seen them in such environment cannot but conclude that the colouring, varied though it be, is protective. It is in perfect harmony with the variegated environment. The hues of the crabs blend remarkably with the colours of the fallen leaves among which they live and take shelter. This, I suggest, may be the explanation of the variation. [However, in open fields (agricultural land) the yellowish white 'type' appears to be predominant and at a distance may resemble a piece of quartz.] But with the weeks of rain the carpet of leaves loses its variegated colours; the leaves decompose and become black, and with the change of scene the purplish brown and mottled crabs 'disappear', leaving only the yellowish white ones. What became of the darker coloured crabs which were so common at the onset of the rains? Do they lose their richer tones and become yellowish? Are the darker ranges of colour but a temporary phase? This, I believe, is what happens. Purplish brown crabs which I kept in captivity lost their richer hues after a while and became pale yellow. There is presumably a definite bleaching process at work and this seems to me to be the only plausible explanation of the 'disappearance' of the crabs exhibiting the deeper ranges of colour. The yellow crabs are now fairly conspicuous objects against the dark humus of the ground or rocks. The protective colouring has been discarded. A factor which was till then apparently significant to the species in the struggle for existence is now no longer of importance. For, by the time the crabs have assumed this phase of colouring their existence is no longer essential to the continuance of the species. On emergence, the females, laden with young, are in need of protection but by the time their colouration has faded and all the crabs are uniformly yellow the young have been shed—they have accomplished their chief duty in life.

There is perhaps one serious objection to the theory of protective adaptation, namely, the colouration of the males, which as we shall observe later, have no need for such protection. However, the colouring may be due to some deep-seated physiological character which is common to both sexes and is beyond the scope of this paper. Nevertheless the colour protective adaptation is again supported by the colouring of the young.

*Young:* Young crabs, while still in the care of the mother are earthy brown in general tone with a slight tinge of flesh pink on the pincers. The carapace is really translucent and the brown colour is mainly due to the colouration of the internal organs showing through. As the young crabs are generally deposited in or find their way to flowing water, where they live and develop, the brown colouring makes it almost impossible to see them against earth. As growth proceeds, and this is fairly rapid, the crablings become lighter and lighter in colour eventually becoming yellowish white (some are pale reddish brown). This change from brown to yellow appears to be mainly due to the deposition of calcareous

matter within the shell (exoskeleton). Accordingly the shell becomes more opaque and in old crabs is heavily calcified throughout—a sure sign of old age! The carapace of crabs of the season are usually semi-translucent and the contents of the crab frequently show through making that region darker than its surroundings. By the end of the rains, after several months, the adult stage is reached.

#### BREEDING.

There appears to be little definite knowledge regarding the breeding habits of these crabs. In volume iv, p. 190 of the *Cambridge Natural History Series* dealing with the Crustacea and Arachnids, the author writes:—‘The fresh-water crab *Thelphusa fluviatilis*, common in the South of Europe and on the North coast of Africa, belongs to the Cyclometopa, and is interesting from its direct mode of development without metamorphosis.’ There is no doubt that we have the same direct development in *guerini* which belongs to a closely allied genus. The actual period at which mating takes place is still unknown.

On emergence the primary concern of the crab is the continuance of the species. However, as the females are laden with fully developed young, breeding evidently took place much earlier. When the crabs appear after the break of the rains, the females appear to be predominant in certain localities while in others there seem to be mostly males. The majority, if not all, the females are laden with young scarcely half a centimeter across the carapace. The number of young carried by each female seems to depend largely on her size. The young are held in a compact mass by the abdominal segments and the *pleopods*—metamorphosed swimmerets.

Disturb one of these females; she will either scuttle away to safety, dropping several of her young as she goes, or she will stand on the defensive. This ‘premature’ shedding of her young probably results from excitement on the part of the parent as she tightens her hold on the mass of young, thereby pressing some out. Generally the young remain with the mother for several days before she ‘sheds’ them or they leave on their own accord, when ready to fend for themselves. Nevertheless, crablings are quite capable of supporting themselves at a very early age.

As we have already observed, the adult females emerge from their burrows with their young fully developed. In all my wanderings I have never observed crabs in copula. The questions naturally arise, When do they copulate? and, When are the eggs deposited and hatched? The answers to these questions are yet awaited. One thing is certain, and that is, that the eggs are laid and hatched when the crabs are underground.

According to Mr. Wagle (Dept. Agric. Bom., Bull. No. 118 of 1924, *Land Crabs as Agricultural Pests in Western India*, p. 20), the burrows are interconnected, ‘If the openings of a burrow are further traced it is seen that most of them are connected superficially within a foot or two of the soil surface, though ramifications at a depth of four or five feet are not uncommon. A few only

go deep down and each one of these burrows harbours a crab, probably the off-spring of the same mother liberated in the same burrow in connection with the mother burrow.' However, in none of his diagrams does Mr. Wagle indicate that there are any such interconnecting passages. If the burrows are thus interconnected, the crabs are able to visit each other during the period of aestivation, so that it is really immaterial whether several crabs aestivate together in one chamber or alone in separate chambers—the sexes would have access to one another.

Considering the data we have before us, it is possible and even probable that copulation generally takes place within the burrows. Whether crabs are active within their burrows throughout the dry weather is yet another point which needs investigation.

#### GROWTH.

*Crablings*: As already indicated, the females emerge laden with young. The young are but miniatures of the adults. After a brief period of maternal care the young are 'shed' and have to fend for themselves. The country is teeming with them. The number of young produced by a single female appears to be dependent on her size, small females having fewer young than larger ones. The greatest number I have recorded from a single individual was 252—what a family! Each youngster at this stage measures a little over 5 mm. across the carapace. Should the young at this age fall away from the parent they frequently climb back into the mass and remain with her, if unable to do so, they are quite able to fend for themselves.

During the early period of their lives crablings spend far more time in water than do the adults, feeding on the bottom of small streams.

*Moult*: At the time of moult crabs usually secrete themselves under stones, in holes or remain submerged in water. I have repeatedly found crabs soon after they had moulted and once had the pleasure of seeing one 'walk out of its old self'. The carapace splits horizontally across the 'face' of the crab and opens like the lid of a box. The creature then gradually and laboriously draws itself out of its 'old skin' and then sinks down to rest till its coat of mail hardens once more. On emergence from the old shell the animal is generally perfectly white (sometimes tinged with pink), soft and defenceless. It is limp and unable to walk; it lies almost motionless till it has hardened again. If the crab be bruised at this period a milky exudation takes place. The hardening process is slow.

#### SENSES.

*Sight*: Sight is well developed.

*Smell*: The sense of smell is apparently very keen. Experiments by way of drawing a piece of meat tied to a string through water which was then removed, clearly indicated that the crabs were able subsequently to follow the trail quite easily. Again meat juice dropped in the water immediately attracted the crabs. They

would grope about with their pincers in the line taken by the flow of the juice.

*Sounds*: At first it might appear strange that a crab is able to produce any kind of sound at all. Nevertheless, it is capable of making quite an audible hissing noise on occasions. This is effected by rapidly 'blinking' the eyes in and out of their sockets. At first, when I heard this sound, I thought that my ears deceived me, but when I listened more closely and watched the animal I soon discovered how it was made. The lower margins of the eye sockets are provided with a fringe of stiff hairs. This undoubtedly forms a natural brush for cleaning the eye itself—an automatic cleaning apparatus! When this fringe is dry and the eye is rapidly moved across it, it produces a soft hissing sound. The sound I have noticed only when 'dry' crabs are freshly caught. Having once discovered this I paid a little more attention to it. It seems to be a habit of the crab to produce this sound when closely approached and when caught. This noise is apart from the usual bubbling noise made in the process of respiration.

#### HABITS.

*Burrows*: The burrows are at first made large enough to admit the crab sideways and to allow of the free play of the pincers. As the crab grows it enlarges the burrow accordingly. The burrows are made either in the fields themselves or more often in the bunds, but the site of the burrow is dependent on the amount of water present. When the fields are flooded the crabs seek higher ground, such as the bunds, for if the burrows were continually under water the animals would be drowned. Towards the end of the rains, when the water level in the soil falls, the crabs return to the fields to make their holes and build their final castles. Away from paddy fields, they burrow into the banks of streams just above the usual water level. Final burrows are generally excavated in the bed of the streams. Unfortunately, lack of time and opportunity have prevented me from making a systematic study of the course of the burrows. According to Mr. Wagle (l.c.) the crabs dig down deeper and deeper as the level of the water falls. The course is irregular and the burrows are interconnected by side tunnels.

*Life under ground*: Towards the close of the rains the crabs are to be seen actively excavating burrows, collecting leaves, grasses and other food which is conveyed into the burrow. This they continue till the land surface is almost quite dry. When sufficient storage has been accomplished they retire till the break of the next monsoon. Once the dry period has set in all crabs retire irrespectively whether they are near perennial water or not, though crabs so favourably situated do go down a little later. Within the burrow now lies the secret of the crab's early life-history which still awaits solution.

*'Castles'*: Crabs build small or large castles throughout the rains but the final castles, which are generally larger, are built when they are about to go below the surface. The time when building commences would vary with weather conditions and locality. The building of the castle is an effort to get rid of some

of the earth within the burrow which is piled up at the entrance, but this is perhaps not the only reason. It possibly affords a certain amount of protection to the burrow by keeping off would-be intruders. Fallow fields and low lying land are favourite sites for the final burrow.

The walls of the castles are composed of pellets of mud brought up when still wet. The pellets are heaped up on each other and eventually form a compact mass. These pellets appear like excreted earth or a fine mixture of mud with some secretion. The castles are frequently conical in shape and may occasionally rise a foot or more above the surrounding ground, but they usually vary between 2 and 8 inches in height. When the castle is complete, the entrance of the burrow is plugged up from within and the crab enters on its long period of life under ground.

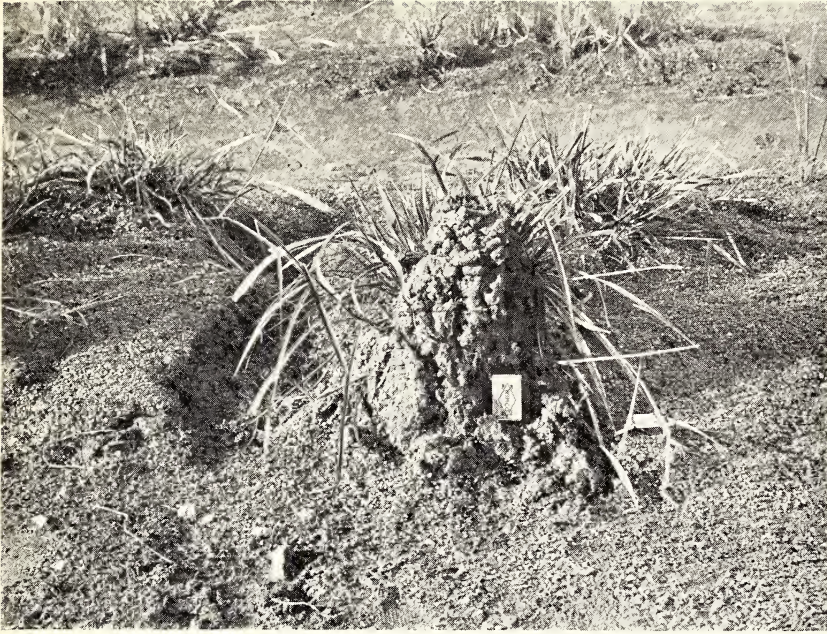
Why these castles are constructed is problematic. As already suggested it may be to keep off intruders. At the time when the crab is about to aestivate there are numerous other animals which are also looking for a suitable retreat. Some are unable to excavate their own burrow; others prefer to find a convenient ready made burrow rather than dig one, and find a crab hole convenient. If the entrance of the crab's burrow were flush with the ground the entrance with its fresh plug of mud would be easily accessible. But as the entrance is raised and the walls of the castle solid they act as a bluff which is mistaken for a clod of earth!

When the crabs first appear the females are a lot more cautious than the males and are less frequently seen in the open. When sufficient rain has fallen to make puddles and cause the streams to flow, the females laden with young congregate on the banks and in the water. During this period the females spend much time submerged on account of their young and it is also at this period that the young leave the parent. In such localities there is always a sufficiency of hiding. On the slightest alarm they hurry away.

During showers and under the cover of darkness the adults wander about much, but when the sky is cloudy or sunny they make for the water.

As the monsoon advances the adult crabs tend to decrease in numbers very rapidly and considerably. The younger generation now take their place. Where do the old crabs go or what happens to them? Do they die out or retire into their burrows once more? These are questions that started me off on these investigations. Some may volunteer the opinion that the crabs disappear in the vegetation. This I am not prepared to accept as young crabs are all about. That they do not retire to their burrow is certain for they would be drowned, as they are not able to stand submergence indefinitely. From personal experience, I am of the opinion that these crabs live but one year and that they die in the open during the monsoon or soon after.

When within the burrows, the chelae are generally carried adpressed to the body, but in case of attack the chela nearest to the intruder is placed at the entrance ready for action. Once a crab seizes an intruder it will not let go easily. This frequently



A castle of the common Land Crab. [*Paratelphusa (B.) guerini* (M.—Eds.)] in an unused field at the end of the rains. (Match box for comparative size).



Several castles of the common Land Crab. [*P. (B.) guerini* (M.—Eds.)] in a field at the close of the monsoon.





leads to the loss of the chela or the capture of the crab. This habit is common to most crabs and is frequently made use of as a ruse to capture them. People who catch crabs by this method tie a piece of meat to the end of a stick. The stick is thrust down the burrow. The crab in time seizes the bait and is gradually drawn out of its hole. The hole is then blocked with the free hand or foot and the crab is caught. Nevertheless this habit of the crab though it may frequently lead to its death at the hands of men is also a means of securing much of its animal food.

Whether these crabs are nocturnal or diurnal or both, is a difficult matter to decide. This would depend much on weather conditions. The crabs are about both day and night during the short period of their activity on the surface. When the weather is cloudy and rain is continuous they may be seen about at any time of the day or night. However, I am inclined to believe that they are more nocturnal as they appear to be much more numerous and active under the cover of darkness. At night they wander farther from their burrows. Apart from the fact that the crabs do not like direct sunlight which desiccates their gills, they probably find a certain amount of protection from their enemies at night.

Another point that needs consideration is that their period of activity is during the monsoon when the sky is overcast with dense clouds, so it is not surprising to find them about during the day. When the sun appears between showers and it gets really hot, the crabs retire to a goodly extent, if not into their burrows, into water or shade.

Though these crabs cannot remain submerged for many hours at a stretch, they are as well at home in water as on land; but they are not able to swim. They merely crawl along the bottom. During the monsoon, when the air is damp, they are able to remain on land for weeks without showing any ill effects. This indicates that they are well adapted to terrestrial life.

When the crab respire on land bubbles appear continuously at the mouth, but when in shallow water, the mouth parts are lifted above the surface from time to time and then submerged; at the time a series of bubbles arise from near the base of the last pair of legs. This action is continuous.

These crabs do not appear to be pugnacious. They frequently live together in the same hole (during the rains) and inhabit the same pools feeding within close range of another. However, I have frequently observed a crab resent the entrance of a particular individual into its burrow whereas another went in unmolested. Whether this behaviour indicates a certain social grouping or whether it is just a submission of a weaker to a stronger one is hard to say. Occasionally there are fights but these contests take on more the form of sham-fights—there is much display of arms but actual damage is seldom done, as one of the combatants usually runs away. Young crabs, as is a common rule in Nature, have a certain amount of respect and fear for their elders. Whether these crabs are really cannibalistic, in so much as they kill and eat one another, is difficult to say; but, it is certain that they

frequently eat their dead, picking the soft parts out of the shells. On the whole they appear quite peaceable among themselves. This is borne out by the fact that several may be kept in the same container, if not too crowded, without difficulty.

Generally the sexes may be distinguished by the fact that the males usually carry larger chelae of which one, either right or left, (though generally the left) is larger than the other. Another point which is worthy of note is that on dissection I found that the fat bodies in the females are bright yellowish orange whereas in the males they are dull and not yellow.

*Food:* Like most crabs, this land crab is omnivorous and it is an excellent scavenger and controller of injurious pests, as we shall notice when we review its menu. Little escapes its attentions. Fresh and decomposing vegetable and animal matter are all included in its diet. Leaves, algae, fruit, insects, amphibia, reptiles dead or alive, are all welcome. Much of the meat is caught at the entrance of the burrows and shelters. Unwary fish are caught as they swim by the submerged crabs. These food observations are not mere generalizations but are based on either experiment or experience in the field.

Once I saw a two-foot-long Checkered Water Snake (*Tropidonotus piscator*) wriggling violently with its head held fast under a stone as though it had been pinned. The behaviour was curious. I pulled at the tail of the snake to find it firmly held. On removal of the stone I discovered that a large crab had the head of the snake in its pincers! Probably the snake went under the stone for shelter or in quest of food, but the crab had forestalled it. When the stone was removed the snake struggled frantically with the crab still holding on. Eventually the crab lost its chela but it still remained affixed to the head of the snake. On another occasion I witnessed a crab dragging a much larger corpse of the same species of snake across an expanse of rock. The back had been partially eaten. I watched the proceedings till the snake disappeared into the crab's burrow. I have frequently witnessed crabs taking things home.

Earth-worms form a good portion of their diet. These they usually catch when abroad at night or when the worms come out during the day. I have frequently seen crabs catch living frogs, lizards, beetles, moths, grasshoppers and other insects. Carcasses of any sort when near or in water are frequently covered with crabs.

If one watches a crab feed on wet rocks or at the bottom of a stream, it will be noticed that it is continually ferreting about for some invisible object which is conveyed to the mouth. The pincers are going to and fro from the rock to the mouth and *vice versa*. They appear to be groping for algae. Crabs are seldom guilty of a breach of etiquette—they never overfill the mouth! Particles of food are usually minute. The food is dissected by the pincers into minute bits before it is conveyed to the mouth; but one may occasionally see a crab hold up a large piece at its mouth and get its strong jaws into action.

If a crab had to rely entirely on its pincers for its food, those that have lost them would die of starvation. This thought puzzled

me for a time, but a pincerless crab solved the problem for me by a practical demonstration. It lowered its mouth to a piece of meat and worked at it with its jaws. This of course was a rare occasion as crabs are usually very careful of their pincers. While on the subject of missing pincers, it might be mentioned that missing limbs are not replaced.

*Enemies*: Apart from man, these creatures have a wide circle of natural enemies: mammals, birds, reptiles and amphibians all take a fair toll. In addition to these animals which prey on crabs for food, there are parasites.

*Mammals*: among the mammals jackals, civets, mongooses and rats exercise a fair check. Otters live largely on crabs. (Though I strongly suspect the presence of otter in Salsette, I have never been able to confirm this. My suspicions are based on droppings.)

*Birds*: Birds take a heavy toll of young and old crabs. The Malabar Whistling Thrush (*Myophonus horsfieldii*) is perhaps the foremost. This bird catches the crabs, batters them against the rocks till the carapace is broken and feeds on the soft part, but young crabs are often swallowed whole. The White-breasted Kingfisher (*Halcyon smyrnensis*) is another in the vanguard. Crows, herons, egrets, kites and probably a host of other birds also feed on this crab.

*Reptiles*<sup>1</sup>: Among the reptiles, the Bloodsucker (*Calotes versicolor*) and Skinks (*Mabuia carinata*) are not averse to taking small crabs that they can overpower and conveniently swallow. So far I have no evidence of any snake eating a crab.

*Amphibians*: In the ranks of the amphibians are found the greatest enemies of the crabs. The bull-frog (*Rana tigrina*) and the common toad (*Bufo melanostictus*) account for a very large number of young of all sizes and the bull-frog will swallow almost full-grown specimens. The skipper (*R. cyanophlictis*) undoubtedly feeds on small crabs, but for this species I have no actual evidence.

The calcareous shells are not digested but are passed in fragments in the excreta.

*Parasites*: Crabs also suffer from several parasites, both internal and external. In Salsette I have found the leech (*Paraclippus vulnifera* Harding) a serious pest on this crab. It attacks the soft parts at the joints of the limbs and the gills and the lining of the gill chamber. The largest number removed from a single crab was 27, some were attached to the joints but the majority were in the gill chamber. In spite of the accumulation of leeches the crab did not appear to be greatly inconvenienced. Leeches infest the crabs mostly towards the end of the rains. The gill chambers seem to be the breeding ground and when the crab moves about in water the leeches, both young and old, come out of the chambers and wander about the carapace. I am of the opinion that the leeches also use the gill chambers during the dry season as a convenient harbour to tide over this period.

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<sup>1</sup> Since writing the article I caught a young *Varanus bengalensis* and found that its stomach contained almost exclusively young crabs.

This particular species of leech has only once been reported from South India affecting another species of the same genus of crab, *P. hydrodromus*.

Rao Sahib Y. Ramachandra Rao, in 'A note on *Paratelphusa hydrodromus* Herbert, The Fresh-water Crab of South India' (Proc. 5th Ent. Meet., Pusa, 1923, p. 138) writes 'The bronchial chambers of these crabs are found to be infested by a species of leech. Leeches are generally suckers of blood and in this case they are very probably true parasites on the crab, attacking the membrane of the bronchial chamber and the gills and sucking the body juices. Generally three or four may be found in each crab, but in one case fourteen large leeches, besides two or three young ones were noted in a single crab. It is however doubtful if the leech, even if present in large numbers, will form any efficient check on the crab.'

*Legend or Observation?* In India there is a current belief that the jackal catches crabs by thrusting its tail down the burrow of the crab. The crab seizes the tail and is then pulled out of its hole and devoured. Curiously enough there is a very similar story told by Olaus Maginus, a Scandinavian Bishop, who lived in the sixteenth century, about the fox. This good church dignitary has been responsible for the most fantastic 'unnatural' history stories. He says: 'Sometimes fearing the multitude of wasps, he counterfeits and hides himself, his tail hanging out and when he sees that they are all busy, and entangled in his tail, he comes forth, and rubs them against a stone or tree and kills them and eats them. The same trick, almost, he useth, when he lyes in wait for crabs and small fish, running about the bank, and he lets down his tail into the water, they admire it, and run to it, and are taken in his fur and pulled out.'

*Land Crabs and Agriculture:* From an agricultural aspect land crabs in general (and the genus *Paratelphusa* in particular) are considered serious pests to paddy crops in certain districts. I have already quoted Mr. Fletcher's remarks in this connection. Mr. Ramakrishna Ayyar referring to the same subject in the Madras Presidency said:

'... It has been observed that damage may be very serious in areas where single seedling transplantation of paddy is done. It appears that the crabs have been attacking paddy for several years but the damage was noticed before the practice of transplantation was to put in bunches of several seedlings.'

It is strange that single transplantation was still continued and the old method not adhered to when damage to single seedlings proved devastating! In Salsette, bunches of seedlings are transplanted, never single seedlings. Careful watching of the paddy fields has shown me conclusively that the damage to paddy crops is negligible in the island. The only period at which I have noticed *P. guerini* nipping leaf blades is before the transplanting of the seedlings. This is generally done by the crabs inhabiting the field of seedlings, but there is no invasion of the field. However the damage is not severe. After transplanting the damage is negligible. A little leaf-collecting is done when the animals are about